Atari, Inc.
1312 Crossman Ave.
P.O. Box 61657
Sunnyvale, CA 94088

Dear Atari Customer:

If you wish to have technical information on your new XL computer, other than the following information which we can send you:

XL Guidelines (memory changes from 800 to XL)
XL Memory Map (general)
XL New Graphics Modes
XL Useful Memory Locations
XL Redefinable Keys
XL Port B Changes

you will need to buy:

Technical Reference Notes (C016555)	$29.95
California sales tax	1.80
Santa Clara county sales tax	00.15
TOTAL	$31.90

plus the:

XL Addendum (CO24515-001)	$4.95
California sales tax	.30
Santa Clara county sales tax	0.02
TOTAL	$5.27

The Technical Reference Notes include the 400/800 Operating System User's Manual, the 400/800 OS Source Listing, and the 400/800 Hardware manual. Most of this is directly applicable to the XL computers, and the differences in the Operating Systems are explained in the Addendum. At present the XL Source Listing is not available, but is scheduled for release second quarter, 1984.

The above literature may be obtained by sending a check payable to Atari, Inc. for the appropriate amount, and a short cover letter naming the items desired, to:

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If you have further questions or comments, please feel free to write or call our toll-free numbers: (800)672-1404 (inside CA), (800)538-8543 elsewhere. Thank you.

Sincerely,

Product Specialist
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GUIDELINES

References are made in the following paragraphs to the Operating System User's Manual which is included with the ATARI Home Computer System Technical Reference Notes (CA016555, Rev. A, copyright 1982 ATARI, INC.), XL Addendum (CO24515-001, Rev. A, copyright 1983). The notes can be ordered from your local ATARI Home Computer retailer or through ATARI by calling 800-538-8543 (outside California) 800-672-1404 (inside California).

NOTE: Many popular computer magazines and textbooks provide sample programs which break some of the guidelines presented below. One common example is the provision of so-called "useful POKE locations" for ATARI BASIC programmers without any mention of which variables are internal. Do not assume that a program will run on an ATARI XL Computer if it uses a technique from a published source that breaks any of the following guidelines. Use the Operating System User's Manual as the authoritative source if there is any doubt about the legality of a specific programming decision.

Violation of any of the following guidelines could cause a program to malfunction on an ATARI XL Computer. Programs written entirely in ATARI BASIC which do not use the PEEK or POKE instructions should have no compatibility problems. All other programs which do not deliberately attempt to violate one of the rules below are probably also compatible.

Note that the following paragraphs use the convention of preceding hexadecimal numbers with a "$".

1. There are no "spare" locations in the operating system database. Memory locations $0000-$007F and $0200-$047F are reserved and should not be assigned to user variables or constants. For example, programs which assign values to the previously unspecified locations $02C9-$02E3 are likely to fail in the XL O.S..

2. "User accessible" variables (such as the left margin of text area, LMARGN at $0052, and the cursor inhibit, CRSINH at $02F0) have retained their original addresses. However, "internal" and "temporary" variables may have been moved, so no attempt should be made to access them. For example, PBUFSZ, previously at $02DF, has been relocated.

   WARNING: NEWROW and NEWCOL, previously at $0060 and $0061, respectively, have been relocated. They are internal variables even though they are specifically referenced in the ATARI 400/800 BASIC Reference Manual.

3. System calls to operating system routines should use only "advertised" entry points and vectors. These addresses are provided in Appendix J of the Operating System User's Manual. Vectors labeled "for OS internal use only" (such as DISKIV), or found from scanning the operating system listing may have moved and should not be used.

4. No attempt to detect BASIC, PILOT, or other types of cartridges should be made. Since no documented procedures exist for doing so, revisions to these cartridges could cause such programs to fail. Similarly, no attempt should be made to execute a jump directly into cartridge ROM.

5. Programs should conform to the interfaces described in the Operating System User's Manual with regard to:

   Power up initialization (coldstart).
   RESET initialization (warmstart).
   Interrupt processing.
   System time utilization.
   I/O operations.
   Floating point operations.
   Memory management.

6. Programs should not rely upon "side effects" of system functions. The interface for each operating system function is documented; since "bonus" features such as finding a useful constant in a register upon return cannot be relied upon, they should not be used.

7. The "initialization values" given in section 6 of the early versions of the Operating System User's Manual are not valid for the XL O.S.. They should not be relied upon.

8. No attempt should be made to access the hardware register PORTB, at memory location $D301 (54017 decimal). Since the two game ports formerly controlled by PORTB have been eliminated from the XL line, it has been reallocated for other purposes.

9. System calls to O.S. routines should utilize only "advertised" entry points and vectors. These addresses are provided in Appendix J of the Operating System User's Manual, and they fall in two address regions: 1) $E400-E47F (Rev A/B) for the operating system, and 2) $D800-DFFF for the floating point package.

10. The character set definitions are at locations $E000-E3FF and $CC00-CFFF for the international character set.

XL MEMORY MAP

The following memory map assumes that DOS 2.0S is booted with a graphics mode 0 screen in BASIC.

HEXIDECIMAL	DECIMAL	USE
0000-007F	0-127	OS page zero RAM
0080-00FF	128-255	user page zero RAM (BASIC)
0100-01FF	256-511	6502 stack
0200-05FF	512-1535	OS RAM
0600-06FF	1536-1791	FREE RAM
0700-1CFB	1792-7419	DOS
1CFC-9C1E	7420-39966	user RAM (BASIC)
9C1F-9FFF	39967-40959	display list and screen RAM
A000-BFFF	40960-49151	BASIC cartridge
C000-CBFF	49152-52223	OS ROM
CC00-CFFF	52224-53247	OS ROM (intn'l character set)
D000-D0FF	53248-53503	GTIA registers
D100-D1FF	53504-53759	reserved for future use
D200-D2FF	53760-54015	POKEY registers
D300-D3FF	54016-54271	PIA registers
D400-D4FF	54272-54527	ANTIC registers
D500-D7FF	54528-55295	reserved for future use
D800-DFFF	55296-57343	OS ROM (floating point package)
E000-E3FF	57344-58367	OS ROM (domestic character set)
E400-FFFF	58368-65535	OS ROM

PIA PORTB at 54017 ($D301) is used to control the memory management in the XL Computers. Bit 0 controls access to the OS ROM and is normally enabled (bit=1). Setting the bit to 0 will disable the OS ROM in the region $C000-$CFFF and $D800-$FFFF and enable the RAM. Unless another OS has been provided, the system will crash on the next interrupt.

Bit 7 controls access to RAM in the region $5000-$57FF and is normally enabled (bit=1). Setting the bit to 0 will disable the RAM and remap the memory access such that the OS ROM is accessed. This provides access to the self-test code physically present at $D000-$D7FF.

XL MEMORY LOCATIONS

The following is a list of useful memory locations that are unique to the XL Operating System.

FUNCTION	LOCATION	DESCRIPTION
KEY REPEAT DELAY	POKE 729,N	N = # VBLANK INTERVALS (DEFAULT = 48)
KEY REPEAT RATE	POKE 730,N	N = #VBLANK INTERVALS (DEFAULT = 6)
KEY CLICK	POKE 731,0	ENABLE
	POKE 731,255	DISABLE
HELP KEY	POKE 732,0	CLEAR
	PEEK(732)	17 = HELP
		81 = [SHIFT] + HELP
		145 = [CONTROL] + HELP
KEYBOARD USE	POKE 621,0	ENABLE
	POKE 621,255	DISABLE
TEXT FINE SCROLLING	POKE 622,255:GRAPHICS 0	FINE SCROLL
	POKE 622,0:GRAPHICS 0	COARSE SCROLL
INTL CHAR SET	POKE 756,224	DOMESTIC (DEFAULT)
	POKE 756,204	INTERNATIONAL
OS ROM ID	PEEK(65527)=221	
	PEEK(65528)=87	400/800 REVISION A
	PEEK(65527)=243	
	PEEK(65528)=230	400/800 REVISION B
	PEEK(65527)=10	1200XL REVISION A
	PEEK(65527)=11	1200XL REVISION B
	PEEK(65527)=1	600XL
	PEEK(65527)=2	800XL

O.S. DATA BASE CHANGES FROM REV. B TO XL O.S.

This is a list of the differences in memory usage between the Rev. B operating system of the A400/800 and the operating system developed for the XL Computers.

LOCATION	REV. B USE	XL USE		
0000	reserved	LNFLG	--	for inhouse debugger
0001	reserved	NGFLAG	--	for power-up selftest
001C	PTIMOT moved (0314)	ABUFPT	--	reserved
001D	PBPNT moved (02DE)	"		
001E	PBUFSZ moved (02DF)	"		
001F	PTEMP (deleted)	"		
0036	CRETRY moved (029C)	LTEMP	--	loader temp.
0037	DRETRY moved (02BD)	"		
004A	CKEY moved (03E9)	ZCHAIN	--	handler loader temp.
004B	CASSBT moved (03E9)	"		
0060	NEWROW moved (02F5)	FKDEF	--	func key def ptr.
0061	NEWCOL moved (02F6)	"		
0062	" (02F7)	PALNTS	--	PAL/NTSC flag.
0079	ROWINC moved (02F8)	KEYDEF	--	key def pointer
007A	CLINC moved (02F9)	"		
0233	reserved	LCOUNT	--	loader temp
0238-0239	"	RELADR	--	loader
0245	"	RECLEN	--	"
0247	LINBUF (deleted)	reserved		
0248-026A	"	"		
026B	"	CHSALT	--	character set ptr
026C	"	VSFLAG	--	fine scroll temp
026D	"	KEYDIS	--	keyboard disable
026E	"	FINE	--	fine scroll flag
0288	CSTAT (deleted)	HIBYTE	--	loader
028E	reserved	NEWADR	--	loader
029C	TMPX1 (deleted)	CRETRY	--	from 0036
02BD	HOLD5 (deleted)	DRETRY	--	from 0037
02C9-02CA	reserved	RUNADR	--	loader
02CB-02CC	"	HIUSED	--	loader
02CD-02CE	"	ZHIUSE	--	loader
02CF-02D0	"	GBYTEA	--	loader
02D1-02D2	"	LOADAD	--	loader
02D3-02D4	"	ZLOADA	--	loader
02D5-02D6	"	DSCTLN	--	disk sector size
02D7-02D8	"	ACMISR	--	reserved
02D9	"	KRPDEL	--	auto key delay
02DA	"	KEYREP	--	auto key rate
02DB	"	NOCLIK	--	key click disable
02DC	"	HELPFG	--	HELP key flag
02DD	"	DMASAV	--	DMA state save
02DE	"	PBPNT	--	from 001D
02DF	"	PBUFSZ	--	from 001E
02E9	"	HNDLOD	--	handler loader flag
02F5	"	NEWROW	--	from 0060
02F6-02F7	"	NEWCOL	--	from 0061
02F8	"	ROWINC	--	from 0079

DATA BASE CHANGES FROM REV. B TO XL LINE (cont'd)

LOCATION	REV. B USE	XL USE		
02F9	"	COLINC	--	from 007A
030E	ADDCOR (deleted)	JMPERS	--	option jumpers
0314	TEMP2 moved (0313)	PTIMOT	--	from 001C
033D	reserved	PUPBT1	--	power-up/reset
033E	"	PUPBT2	--	"
033F	"	PUPBT3	--	"
03E8	"	SUPERF	--	screen editor
03E9	"	CKEY	--	from 004A
03EA	"	CASSBT	--	from 004B
03EB	"	CARTCK	--	cart checksum
03ED-03F8	"	ACMVAR	--	reserved
03F9	"	MINTLK	--	"
03FA	"	GINTLK	--	cart interlock
033FB-03FC	"	CHLINK	--	handler chain

XL NEW GRAPHIC MODES

The XL O.S. has been enhanced to allow BASIC to establish 4 graphics modes that were not available with the 400/800 OS. In BASIC these are graphics modes 12-15.

GRAPHICS MODE 12

This mode sets up a display list of ANTIC mode 4 which is a 4-color character mode. Each character displayed on the screen will occupy the same physical space as a mode 0 character, i.e. 4 color clocks wide and 8 scan lines high. The difference is that mode 0 displays 8 pixels within the 4 color clocks, while mode 12 displays only 4 pixels. The 8-byte shape definition in the character set is interpreted as bit pairs in mode 12 as opposed to single bits in mode 0.

Mode 12 will use 40 bytes of screen RAM for each of its 20 mode lines. Four mode 0 lines are displayed in the text window. A full 24 mode lines can be accessed with GRAPHICS 12+16.

It is difficult to form a recognizable character in a 4x8 matrix so mode 12 is not recommended for use as a text mode. However, because you can display 4 colors in one "character", it is excellent for animation or background patterns using a redefined character set.

GRAPHICS MODE 13

This mode sets up a display list of ANTIC mode 5 which is a 4-color character mode. Each character displayed on the screen will occupy double the physical space as a mode 0 character, i.e. 4 color clocks wide and 16 scan lines high. Another difference is that mode 0 displays 8 pixels within the 4 color clocks, while mode 13 displays only 4 pixels. The 8-byte shape definition in the character set is interpreted as bit pairs in mode 13 as opposed to single bits in mode 0.

Mode 13 will use 40 bytes of screen RAM for each of its 10 mode lines. Four mode 0 lines are displayed in the text window. A full 12 mode lines can be accessed with GRAPHICS 13+16.

It is difficult to form a recognizable character in a 4x8 matrix so mode 13 is not recommended for use as a text mode. However, because you can display 4 colors in one "character", it is excellent for animation or background patterns using a redefined character set.

GRAPHICS MODE 14

This mode sets up a display list of ANTIC mode $C which is a 2-color map mode with a resolution of 160 across by 192 down. Mode 14 could be thought of as mode 6½ because each mode line is only 1 scan line high whereas mode 6 is 2 scan lines high.

GRAPHICS MODE 15

This mode sets up a display list of ANTIC mode $E which is a 4-color map mode with a resolution of 160 across by 192 down. Mode 15 could be thought of as mode 7½ because each mode line is only 1 scan line high whereas mode 7 is 2 scan lines high.

RECAP

MODE	TYPE	COL	ROW	COLORS	RAM
12	CHAR	40	20	4	1154
28	CHAR	40	24	4	1152
13	CHAR	40	10	4	664
29	CHAR	40	12	4	660
14	MAP	160	160	2	4270
30	MAP	160	192	2	4296
15	MAP	160	160	4	8112
31	MAP	160	192	4	8138

REDEFINABLE KEYS

There are two tables in ROM that the XL O.S. uses to translate keystrokes into ATASCII values. One table is for the keyboard and the other is for the function keys F1-F4. The procedure to redefine a keystroke is relatively simple. First, define an area in RAM memory to store two tables. The keyboard table requires 192 bytes and the function key table requires 8 bytes. Second, store the ATASCII code definitions for the keystrokes in the new table. Third, change the OS data base variable that points to the location of the table.

KEYBOARD

The Keyboard is able to generate 64 hardware keycodes. These codes, 0-63 ($00-$3F) are used to index into the keyboard table to find the appropriate ATASCII value associated with the keycode. When pressed in conjunction with the SHIFT key, the keys generate an additional 64 codes, 64-127 ($40-$7F). When pressed in conjunction with the CONTROL key, the keys generate an additional 64 codes, 128-191 ($80-$BF). Therefore, a 192 byte table is needed for the keyboard table. The hardware keycodes are as follows:

0	L	1	J	2	;	3	F1
4	F2	5	K	6	+	7	*
8	O	9		10	P	11	U
12	RETURN	13	I	14	-	15	=
16	V	17	HLP	18	C	19	F3
20	F4	21	B	22	X	23	Z
24	4	25		26	3	27	6
28	ESC	29	5	30	2	31	1
32	,	33	SPACE	34	.	35	N
36		37	M	38	/	39	ATARI
40	R	41		42	E	43	Y
44	TAB	45	T	46	W	47	Q
48	9	49		50	0	51	7
52	BACKSP	53	8	54		55	
56	F	57	H	58	D	59	
60	CAPS	61	G	62	S	63	A

The O.S. data base variable KEYDEF is located at 121-122 ($79-$7A).

FUNCTION KEYS (1200 XL only)

The function keys F1-F4 can generate 4 hardware keycodes. When pressed in conjunction with the SHIFT key, the keys generate an additional 4 keycodes. Therefore, an 8 byte table is needed for the function key table. When redefining the function keys, do not assign codes 138-141 ($8A-$8D) to keys F1-F4 or a system lockup can occur. The O.S. data base variable FKDEF is located at 96-97 ($60-$61).

SPECIAL FUNCTION ATASCII CODES

Any code in the range 128-145 ($80-$91) will tell the system to perform a specific function as follows:

128	$80	ignore
129	$81	invert video
130	$82	toggle upper/lower case
131	$83	uppercase lock
132	$84	control lock
133	$85	end of file
134	$86	ATASCII
135	$87	ATASCII
136	$88	ATASCII
137	$89	toggle key click
138	$8A	cursor up, ATASCII 28 ($1C)
139	$8B	cursor down, ATASCII 30 ($1D)
140	$8C	cursor left, ATASCII 31 ($1E)
141	$8D	cursor right, ATASCII 32 ($1F)
142	$8E	cursor home
143	$8F	cursor bottom
144	$90	cursor left margin
145	$91	cursor right margin

NON-REASSIGNABLE KEYS

The following keys are not reassignable:

BREAK
SHIFT
CONTROL
OPTION
SELECT
START
RESET
HELP
CONTROL - F1
CONTROL - F2
CONTROL - F3
CONTROL - F4

PORT B CHANGES

Port B of the PIA is a read/write port which no longer is connected to game I/O ports. Instead, its bits control various functions which include control of LED 1, LED 2, read enable of the the OS ROM's and other functions. To change only one single bit at a time within that port, the following technique should be used.

```
Clear A Bit (bit b)
    LDA PORTB
    AND # $FF-b
    STA PORTB ;clears only bit b in the port
Set A Bit (bit b)
    LDA PORTB
    ORA # b
    STA PORTB ;sets only bit b in the port
```

XL PORTB ($D301) BIT ASSIGNMENTS		
BIT	VALUE	USE
0	0	OS ROM DISABLED, RAM ENABLED
	1	OS ROM ENABLED
		The memory region mapped to the OS ROM is from $C000 to $FFFF except for the region from $D000 to $D7FF which is always mapped to the hardware I/O chips (GTIA, POKEY, PIA, ANTIC).
1	0	BASIC ENABLED
	1	BASIC DISABLED, RAM ENABLED
		The memory region mapped to BASIC is from $BFFF.
2	0	LED #1 ON
	1	LED #1 OFF
3	0	LED #2 ON
	1	LED #2 OFF
4		RESERVED FOR FUTURE USE
5		RESERVED FOR FUTURE USE
6		RESERVED FOR FUTURE USE
7	0	SELF TEST ROM ENABLED
	1	SELF TEST ROM DISABLED, RAM ENABLED
		The memory region mapped to the self test ROM is from $5000 to $57FF.

NOTE: The OS VBLANK process copies the port A joystick and paddle values into the Port B shadows. Thus, stick 0 affects both 0 and 2, stick 1 affects both 1 and 3.

*** This page is a reprint from the XL supplement (C024515-001) to the 400/800 Technical Reference Notes (C016555). This supplement pertains to the 1200XL/600XL/800XL computers.